AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

1   1.   (Cancelled)

1   2.   (Currently Amended) The method of claim [[1]]11, wherein the computer further
2 includes a CPU, wherein the virtual machine monitor is in control of the CPU prior to the
3 runtime virtualization of the I/O device.

1   3.   (Currently Amended) The method of claim [[1]]11, wherein the virtualization is
2 performed transparently to [[the]]an operating system.

1   4.   (Currently Amended) The method of claim [[1]]11, wherein the I/O device is
2 compatible with the virtualized I/O device.

1   5.   (Cancelled)

1   6.   (Currently Amended) The method of claim [[5]]11, further comprising
2 configuring [[the]] hardware to trap I/O accesses, and enabling the virtual machine monitor to
3 emulate the I/O device in response to the trapstrapped I/O accesses.

1   7.   (Original) The method of claim 6, wherein the virtual machine monitor uses
2 memory management to trap the I/O accesses.

1   8.   (Currently Amended) The method of claim [[5]]15, wherein the virtual machine
2 monitor can commence commences the emulation virtualization between I/O sequences.

1   9.   (Currently Amended) The method of claim 8, wherein the virtual machine

2 monitor commences ~~emulation~~ the virtualization by intercepting I/O accesses; wherein the

3 virtual machine monitor uses the intercepted I/O accesses to update a state machine, whereby the

4 state machine reflects a state of the I/O device; and wherein the virtual machine monitor

5 examines transitions in the state machine to determine whether the I/O device is in the middle of

6 an I/O sequence.

1   10.   (Currently Amended) The method of claim [[5]]15, ~~wherein~~ further comprising

2 the virtual machine monitor ~~can commence the emulation in the middle of~~ commencing the

3 virtualization during an I/O sequence.

1   11.   (Currently Amended) ~~The method of claim 5~~ In a computer including an I/O

2 device, a method comprising using a virtual machine monitor to commence virtualization of the

3 I/O device at runtime, wherein runtime is a period of execution in the computer after boot and

4 before shutdown of the computer, wherein the virtual machine monitor ~~uses a state machine to~~

5 ~~determine~~ determines whether the I/O device is ~~in the middle of~~ performing an I/O sequence, and

6 delays commencing ~~emulation~~ the virtualization until the ~~state machine indicates~~ virtual machine

7 monitor determines that the I/O sequence has completed.

1   12.   (Currently Amended) The method of claim [[1]]11, wherein the runtime

2 virtualization includes using the virtual machine monitor to emulate I/O device interrupts.

1   13.   (Currently Amended) The method of claim [[1]]11, wherein I/O device interrupts

2 are directed to an operating system prior to the runtime virtualization of the I/O device; and

3 wherein the I/O device interrupts are directed to the virtual machine monitor during and after the

4 virtualization of the I/O device.

1   14.   (Currently Amended) The method of claim [[1]]11, wherein the virtual machine

2 monitor temporarily pauses an I/O sequence by emulating the I/O device as being busy.

1   15.   (Currently Amended) ~~The method of claim 1~~In a computer including an I/O

2   device, a method comprising:

3   using a virtual machine monitor to commence virtualization of the I/O device at runtime,

4   wherein runtime is a period of execution in the computer after boot and before shutdown of the

5   computer, wherein the I/O device has multiple modes of operations;

6   ~~wherein~~ the virtual machine monitor ~~determines~~ determining the mode of the I/O device

7   prior to commencing the virtualization; and

8   ~~wherein~~ the virtual machine monitor ~~restores~~ restoring the determined mode of [[the]]

9   operation after the virtualization.

1   16.   (Currently Amended) The method of claim [[1]]11, further comprising

2   devirtualizing the I/O device at runtime following the runtime virtualization.

1   17.   (Currently Amended) In a computer including hardware, a method comprising:

2   running a virtual machine monitor ~~running~~ on the hardware[[,]];

3   running an operating system ~~running~~ on the virtual machine monitor,

4   wherein the hardware ~~including~~ includes an I/O device, and the I/O device is already

5   virtualized by the virtual machine monitor[[,]]; and

6   ~~a method comprising~~ devirtualizing the I/O device at runtime, wherein runtime is a period

7   of execution in the computer after boot and before shutdown of the computer.

1   18.   (Original) The method of claim 17, wherein the devirtualization is performed

2   transparently to the operating system.

1   19.   (Original) The method of claim 17, wherein the devirtualization includes stopping

2   I/O device emulation at runtime.

1   20.   (Original) The method of claim 17, wherein the virtual machine monitor emulates

2   the I/O device prior to devirtualization; and wherein the devirtualization includes allowing the

3   virtual machine monitor to temporarily stop the operating system from commencing a new I/O

4   sequence.

1   21.   (Original) The method of claim 20, wherein the virtual machine monitor

2   temporarily stops the operating system by emulating the I/O device as being in a "busy" or

3   "device not ready" state.

1   22.   (Original) The method of claim 20, wherein the virtual machine monitor bounds

2   the amount of time the operating system processing is temporarily stopped.

1   23.   (Currently Amended) The method of claim 20, further comprising:

2   wherein the virtual machine monitor [[logs]]logging I/O accesses by the operating system

3   to the I/O device during devirtualization, and

4   replays replaying the log to the I/O device after devirtualization, [[whereby]]wherein the

5   I/O accesses by the operating system are deferred during the devirtualization of the I/O device.

1   24.   (Original) The method of claim 17, wherein the virtual machine monitor waits for

2   I/Os initiated by the virtual machine monitor's driver for the I/O device to complete, and for all

3   expected interrupts from the device to arrive, before ceasing device emulation.

1   25.   (Currently Amended) The method of claim 17, further comprising re-directing

2   interrupts from interrupt handlers in the virtual machine monitor to interrupt handlers in the

3   operating system after performing the devirtualizing.

1   26.   (Currently Amended) The method of claim 17, further comprising, after

2   performing the devirtualizing, configuring the hardware so [[the]] accesses by the operating

3   system to the I/O device no longer trap to the virtual machine monitor.

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1   27.   (Currently Amended) The method of claim 17, wherein the I/O device has

2   multiple modes of operations[[;]], the method further comprising:

3   wherein the virtual machine monitor ~~determines~~ determining the mode of the I/O device

4   prior to commencing the devirtualization; and

5   wherein the virtual machine monitor ~~restores~~ restoring the determined mode of [[the]]

6   operation after devirtualization.

1   28.   (Currently Amended) The method of claim 17, further comprising

2   virtualizing~~wherein~~ the I/O device ~~is virtualized~~ at runtime again after [[having]] performing the

3   devirtualizing ~~been devirtualized~~ at runtime.

1   29.   (Cancelled)

1   30.   (Currently Amended) The computer of claim [[29]]35, wherein the I/O device is

2   compatible with the virtualized I/O device.

1   31.   (Cancelled)

1   32.   (Currently Amended) The computer of claim [[31]]35, ~~further comprising~~

2   ~~configuring~~ wherein the hardware is configured to trap I/O accesses, and ~~enabling~~ the virtual

3   machine monitor is enabled to emulate the I/O device in response to the trapped I/O

4   accesses~~traps~~.

1   33.   (Currently Amended) The computer of claim 32, wherein the virtual machine

2   monitor [[uses]]is configured to use memory management to trap the I/O accesses.

1   34.   (Cancelled)

1   35.   (Currently Amended) ~~The computer of claim 34~~A computer comprising:

2   hardware including an I/O device; and

3   computer memory encoded with a virtual machine monitor for running on the hardware

4 and commencing virtualization of the I/O device at runtime, wherein runtime is a period of

5 execution in the computer after boot and before shutdown of the computer,

6   wherein the virtual machine monitor [[uses]]is configured ~~a state machine~~ to determine

7 whether the I/O device is ~~in the middle of~~ performing an I/O sequence, and ~~delays~~ to delay

8 commencing ~~emulation~~ the virtualization until the ~~state machine indicates~~ virtual machine

9 monitor determines that the I/O sequence has completed.

1   36.   (Currently Amended) The computer of claim [[31]]35, wherein the virtual

2 machine monitor is configured to temporarily ~~pauses~~ pause the I/O sequence by emulating the

3 I/O device as being busy.

1   37.   (Currently Amended) The computer of claim [[29]]35, wherein the runtime

2 virtualization includes using the virtual machine monitor to emulate I/O device interrupts.

1   38.   (Currently Amended) A computer comprising:

2   hardware including an I/O device; and

3   computer memory encoded with a virtual machine monitor for devirtualizing the I/O

4 device at runtime, wherein runtime is a period of execution in the computer after boot and before

5 shutdown of the computer.

1   39.   (Currently Amended) The computer of claim 38, wherein the virtual machine

2   monitor is configured to emulate ~~emulates~~ the I/O device prior to commencing the

3   devirtualization; and wherein the virtual machine is configured to commence ~~commences~~ the

4   devirtualization by temporarily stopping an operating system running on the virtual machine

5   monitor from commencing a new I/O sequence.

1   40.   (Currently Amended) The computer of claim 39, wherein the virtual machine

2   monitor is configured to temporarily ~~stops~~ stop the operating system by emulating the I/O device

3   as being in a "busy" or "device not ready" state.

1   41.   (Currently Amended) The computer of claim 39, wherein the virtual machine

2   monitor is configured to bound ~~bounds~~ the amount of time the operating system processing is

3   temporarily stopped.

1   42.   (Currently Amended) The computer of claim [[39]]38, wherein the virtual

2   machine monitor [[logs]]is configured to log I/O accesses by an operating system to the I/O

3   device during devirtualization, and to replay ~~replays~~ the log to the I/O device after

4   devirtualization.

1   43.   (Currently Amended) The computer of claim 39, wherein the virtual machine

2   monitor is configured to wait ~~waits~~ for I/Os initiated by a virtual machine monitor driver for the

3   I/O device to complete, and for all expected interrupts from the I/O device to arrive, before

4   ceasing device emulation.

1   44.   (Currently Amended) The computer of claim 38, ~~further comprising configuring~~

2   wherein the hardware is configured so operating system accesses to the I/O device no longer trap

3   to the virtual machine monitor after the devirtualization.

1   45.   (Currently Amended) The computer of claim 38, wherein the I/O device has

2 multiple modes of operations; wherein the virtual machine monitor <u>is configured to determine</u>

3 ~~determines~~ the mode of the I/O device prior to commencing <u>the</u> devirtualization; and wherein the

4 virtual machine monitor <u>is configured to restore</u> ~~restores~~ the determined mode of [[the]]

5 operation after the I/O device has been devirtualized.

1   46.   (Currently Amended) The computer of claim 38, wherein the virtual machine

2 monitor [[can]]<u>is configured to further</u> virtualize the I/O device after having devirtualized the I/O

3 device at runtime.

1   47.   (Cancelled)

1   48.   (Currently Amended) The article of claim [[47]]<u>52</u>, wherein the virtualization

2 includes commencing I/O device emulation at runtime.

1   49.   (Currently Amended) The article of claim 48, wherein the ~~software includes a~~

2 virtual machine monitor~~; and wherein the software~~ configures the hardware to trap I/O accesses,

3 and enables the virtual machine monitor to emulate the I/O device in response to the <u>trapped I/O</u>

4 <u>device</u>~~traps~~.

1   50.   (Previously Presented) The article of claim 49, wherein the virtual machine

2 monitor uses memory management to trap the I/O accesses.

1   51.   (Cancelled)

1 52. (Currently Amended) ~~The article of claim 51~~An article for a computer including
2 an I/O device, the article comprising computer-readable memory encoded with a virtual machine
3 monitor for causing the computer to commence virtualization of the I/O device at runtime,
4 wherein runtime is a period of execution in the computer after boot and before shutdown of the
5 computer, wherein the virtual machine monitor ~~includes a state machine for determining~~
6 determines whether the I/O device is ~~in the middle of~~performing an I/O sequence, the virtual
7 machine monitor delaying the commencement of the ~~emulation~~virtualization until the ~~state~~
8 ~~machine indicates~~virtual machine monitor determines that the I/O sequence has completed.

1 53. (Original) The article of claim 52, wherein the virtual machine monitor
2 temporarily pauses the I/O sequence by emulating the I/O device as being busy.

1 54. (Currently Amended) The article of claim [[47]]52, wherein the ~~software includes~~
2 ~~a~~virtual machine monitor ~~for emulating~~emulates I/O device interrupts during the runtime
3 virtualization.

1 55. (Cancelled)

1 56. (Currently Amended) An article for a computer including an I/O device, the
2 article comprising computer-readable memory encoded with ~~software~~a virtual machine monitor
3 for causing the computer to devirtualize the I/O device at runtime, wherein runtime is a period of
4 execution in the computer after boot and before shutdown of the computer.

1 57. (Original) The article of claim 56, wherein the devirtualization includes ceasing
2 emulation of the I/O device at runtime.

1 58. (Currently Amended) The article of claim 57, ~~wherein the software includes a~~
2 ~~virtual machine monitor; and~~wherein the devirtualization includes temporarily stopping an
3 operating system running on the virtual machine monitor from commencing a new I/O sequence.

1   59.   (Original) The article of claim 58, wherein the virtual machine monitor

2   temporarily stops the operating system by emulating the I/O device as being in a "busy" or

3   "device not ready" state.

1   60.   (Original) The article of claim 58, wherein the virtual machine monitor bounds

2   the amount of time the operating system processing is temporarily stopped.

1   61.   (Currently Amended) The article of claim 57, wherein ~~the software includes a~~

2   ~~virtual machine monitor for ceasing the emulation;~~ the virtual machine monitor ~~waiting~~ waits for

3   I/Os initiated by a virtual machine monitor driver for the I/O device to complete, and for all

4   expected interrupts from the I/O device to arrive, before ceasing device emulation.

1   62.   (Currently Amended) The article of claim 56, wherein the ~~software includes a~~

2   virtual machine monitor logs ~~for logging~~ I/O accesses by an operating system to the I/O device

3   during devirtualization, and ~~replaying~~ replays the log to the I/O device after devirtualization.

1   63.   (Currently Amended) The article of claim 56, wherein the ~~software includes a~~

2   virtual machine monitor, ~~the software configuring~~ configures the hardware so operating system

3   accesses to the I/O device do not trap to the virtual machine monitor.

1   64.   (Currently Amended) The article of claim 56, wherein the I/O device has multiple

2   modes of operations; and wherein the ~~software includes a~~ virtual machine monitor ~~for~~

3   ~~determining~~ determines the mode of the I/O device prior to commencing devirtualization; and

4   ~~restoring~~ restore the determined mode of [[the]] operation after the I/O device has been

5   devirtualized.

1   65.   (Cancelled)

1   66.   (Currently Amended) The article of claim [[65]]56, wherein the virtual machine

2   monitor [[can]]causes the computer to further virtualize the I/O device after having devirtualized

3   the I/O device at runtime.